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10/24/01

U.S. ENVIRONMENTAL PROTECTION AGENCY
SUPERFUND DIVISION
77 WEST JACKSON BOULEVARD
CHICAGO, ILLINOIS 60604

October 24, 2001 SE-5J

Mr. Benny Ciddu
Volare Ristorante Italiano
201 East Grand Avenue
Chicago, Illinois 60611

Dear Mr. Ciddu:

Attached is a copy of the U.S. Environmental Protection Agency's radiological survey of the Volare restaurant.

Your cooperation in allowing us access and providing assistance throughout the investigation has been much appreciated. It is our conclusion that there is no evidence of thorium contamination in Volare.

If you have any questions on this matter please feel free to contact me at (312) 886-3601.

Sincerely,

Verneta Simon

Verneta Simon
On-Scene Coordinator
Emergency Response Section #3

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 5
SUPERFUND DIVISION
77 WEST JACKSON BOULEVARD
CHICAGO, ILLINOIS 60604

Survey Report

Volare Ristorante Italiano
201 East Grand Avenue
Chicago, Illinois

October 24, 2001

Larry Jensen, CHP
Senior Health Physicist
Emergency Response Section #3

Background

The Lindsay Light and Chemical Company manufactured gas mantles # with thorium in the Lindsay Light Building at 161 East Grand Avenue, Chicago, Illinois, from 1911 until 1936 (see Attachment 1). In excess of 40,000 tons of radioactive thorium wastes from Lindsay operations were removed from nearby properties since 1993 under Superfund removal actions supervised by the U.S. Environmental Protection Agency (USEPA).

Because the Volare Ristorante Italiano (to be referred to as Volare for the remainder of this report) at 201 East Grand Avenue is east, across St. Clair Street, from the Lindsay Light Building and abuts property where one of the major removal actions occurred, USEPA was concerned that the Volare building might be affected if there were thorium contamination around or inside the building. USEPA arranged with the building owners to conduct a radiological survey.

Types of Measurements

Measurements made were of three types: count rate, exposure rate and radon-220 and radon-222 concentrations (see Attachment 7 for instrument information).

- Count rate in this survey was the gamma-ray count rate level on the FIDLER instrument, measured in counts per minute (cpm). Gamma-rays are the most penetrating type of radiation so that they serve to detect radioactive materials on the surface and also within or behind a material. Count rate is a meter reading that shows how radiation levels vary from place to place.

- Exposure rate is a gamma-ray reading (in micro-roentgen per hour, uR/hr) that is used to compute dose to an exposed individual, measured in millirem (mrem).

- Radon levels are air concentrations for the radioactive gases, radon-220 (from thorium materials) and radon-222 (from uranium materials), measured in picocuries per liter (pCi/L).

Conduct of Survey

All accessible areas of the Main Floor and the Basement were surveyed about 2 inches from floors and walls on July 3, 2001, and October 11, 2001, in walkover surveys with a FIDLER sodium iodide detector. These were seek-and-find measurements to quantify present gamma conditions. Results are reported in counts per minute (cpm) and are good indicators of relative changes in radiation levels from place to place. When count rates reach two to three times background or higher, then further investigation is

Gas mantles are gauze bags dipped in thorium nitrate solution and dried. Tied over a gas jet, they glow brilliantly in a flame. Thorium is radioactive but this is coincidental in that it is the metallic properties of thorium not its radioactive properties that make it useful as a lighting device.

indicated to determine a probable cause for this change. Elevations in count rate may indicate contamination, but may also indicate other conditions, not necessarily associated with contamination (e.g., elevated natural radium in bricks).

Measurements were generally recorded as a range in an area (such as a room or an office) rather than a specific number because meter readings fluctuate due to several reasons: statistical variations in radioactive emissions, variations due to natural radionuclides and cosmic rays, variations due to differences in the natural radioactive composition of materials. Contamination would increase the value at the upper end of the range and would be distinctive from the limits of the background range.

Where levels were of special interest, these were recorded separately, with exposure rate levels measured along with count rate measurements.

Three pairs of radon-220 (thoron) and radon-222 (radon) measurements were made, on the first floor, in a basement office and in the basement where staff were working and appeared to be spending longer periods of time. These measurements assessed the levels of radon gases that might be present from potential thorium and uranium contaminants. It is important to note that radon and thoron are always present in any building such as this, due solely to natural sources. To be attributed to contaminants, the levels would have to be above estimates of natural levels.

The first floor radon and thoron measurements were intended to be representative of levels encountered by workers and patrons. The basement measurements were intended to assess levels for workers in what appeared to be frequented areas. For the radon and thoron computations, the gamma exposure rate at each location was also measured. Measurements ran from July 3, 2001, until July 16, 2001, a period of 13 days.

Results

Count Rate Measurements

Since it would be difficult to identify a location outside of the restaurant, that was sufficiently similar, that could be used as a background site for radiation levels, the lowest readings in the survey were taken as background levels and other readings compared to these. Background is the radiation level considered normal and unaffected by any contaminants. The low end gamma-ray count rate readings were about 1500 - 3000 counts per minute (cpm) [See Attachment 2].

Two areas that were clearly elevated over background were a spot on the wall over the stairs leading to the basement and an area along the wall at the base of these same basement stairs. Levels were as high as 7000 cpm and 8800 cpm, respectively.

Exposure Rate Measurements

Exposure rates were measured at the two highest count rate sites (see Attachment 3).

- Wall along stairs to basement, 12 - 14 micro-roentgen per hour (uR/hr)
- Wall at bottom of stairs to basement, 17 uR/hr

Exposure rates were also measured where radon and thoron measurements were made.

- First floor, over front door, 8 uR/hr
- Basement, office, 4 uR/hr
- Basement, storage room, 4 uR/hr

Using the lowest measured exposure rate readings, background levels were about 4 uR/hr. This is at the low end of normal but is in line with levels listed in a standard reference document where 1 - 16 uR/hr is given as a United States indoor range, with an average of 4 uR/hr [#]

Radon and Thoron Measurements

The three pairs of radon and thoron monitors were taken to be representative of the first floor, the basement office and the basement storage area . These monitors were exposed for 13 days. The average results follow (see Attachment 5).

[#] See Sources and Effects of Ionizing Radiation, Volume I, issued by the United Nations Scientific Committee on the Effects of Atomic Radiation in 2000. Table 7 on page 117 lists United States levels as 12 - 160 nGy/hr indoors as a range for absorbed dose in air and 38 nGy/hr as an average. If these are assumed to be representative of gamma exposure rates in indoors then the levels would be 1.2 - 16 uR/hr and 3.8 uR/hr, respectively.

Table 1: Radon-220/222 average concentrations

LOCATION	RADON-220 (pCi/L)	RADON-222 (pCi/L)
First Floor	1.3	0.0
Basement Storage Room	0.4	1.1
Basement Office	0.0 #	1.2

This level was actually measured as -1.4 pCi/L. A negative concentration is not real. This negative result is believed to be due to mathematical calculations where the terms of the calculation are small and close numerically. Reporting the result as zero is a way of stating the actual concentration is very low.

Conclusions

Gamma count rate measurements throughout the Volare restaurant range from 1500 - 8800 cpm. When compared to a reasonable site background level of about 1500 - 3000 cpm, only two spots stand out as being clearly different from background levels, a spot on the wall at the bottom of the stairs from the first floor to the basement (7500 - 8800 cpm) and a spot on the wall along side of these same stairs (5500 - 7000 cpm).

The higher of these two spots seemed to be associated with brick where a hole had been dug in the wall. The higher levels did not seem to be appreciably affected by the fact the measurements were being made in a slight depression. There were no indicators of any special activities that may have occurred in this area that would contribute to localized contamination. It is believed that, behind the Volare wall, was only the wall of the next building so that there was no room for contaminated soil outside the foundation. It seemed the higher level was associated with the brick itself.

The second of these two spots was about two-thirds of the way up the wall above the stairs, along the first floor-to-basement steps. It was not large, perhaps a foot to a foot and a half in diameter. Again, there were no indicators of any special operation that may have occurred in this area that would have led to contamination. It was not believed there was any soil behind this wall that might be contaminated, thereby raising the gamma exposure rate on the inside wall.

Although the gamma-ray exposure rate was measured at these two elevated spots, these did not require a dose or risk calculation because the cause seemed to be natural and the levels low. Moreover, the spots were isolated and associated with low occupancy and exposure times.

The radioactive gas radon is produced by radium-226 in the Uranium Decay Chain. Uranium is a constituent of the monazite ore used as a source of thorium for mantles and, thus, could be a contaminant along with thorium. However, the maximum radon concentration measured in Volare is less than the average indoor residential radon concentration for the US as estimated by the USEPA (1.3 pCi/L). # The lowest reading, 0.0 pCi/L, may not be exactly zero. At low concentrations, the terms of the mathematical calculation are low and close numerically, thus leading to results that may round to zero. This number should be treated as low since it is probably not exactly zero. Thus, the radon levels measured in Volare (see Table 1 above) should not be seen as excessive nor as a health hazard.

The radioactive gas thoron, is produced by the primary radioactive component of a mantle, namely thorium. The estimated average indoor thoron concentration in the United States is estimated at about 0.3 pCi/L # so the basement levels are about equal to this concentration but the first floor level is about 4 times this average (see Table 1 above).

The lack of any appreciably elevated gamma-ray count rates on first floor does not indicate any contamination there so, even though the thoron levels are elevated over background, there does not appear to be a contributing contamination site.

With regard to a potential thoron health hazard, there does not appear to be one. This is affirmed based upon the fact that this thoron concentration is numerically equal to the estimated indoor radon concentration but has only 13% of the radon risk.## If the risk from average background radon is acceptable, a risk 13% of this is not viewed as a health hazard.

Based upon all the data, there does not appear to be a thorium contamination hazard in the Volare Restaurant.

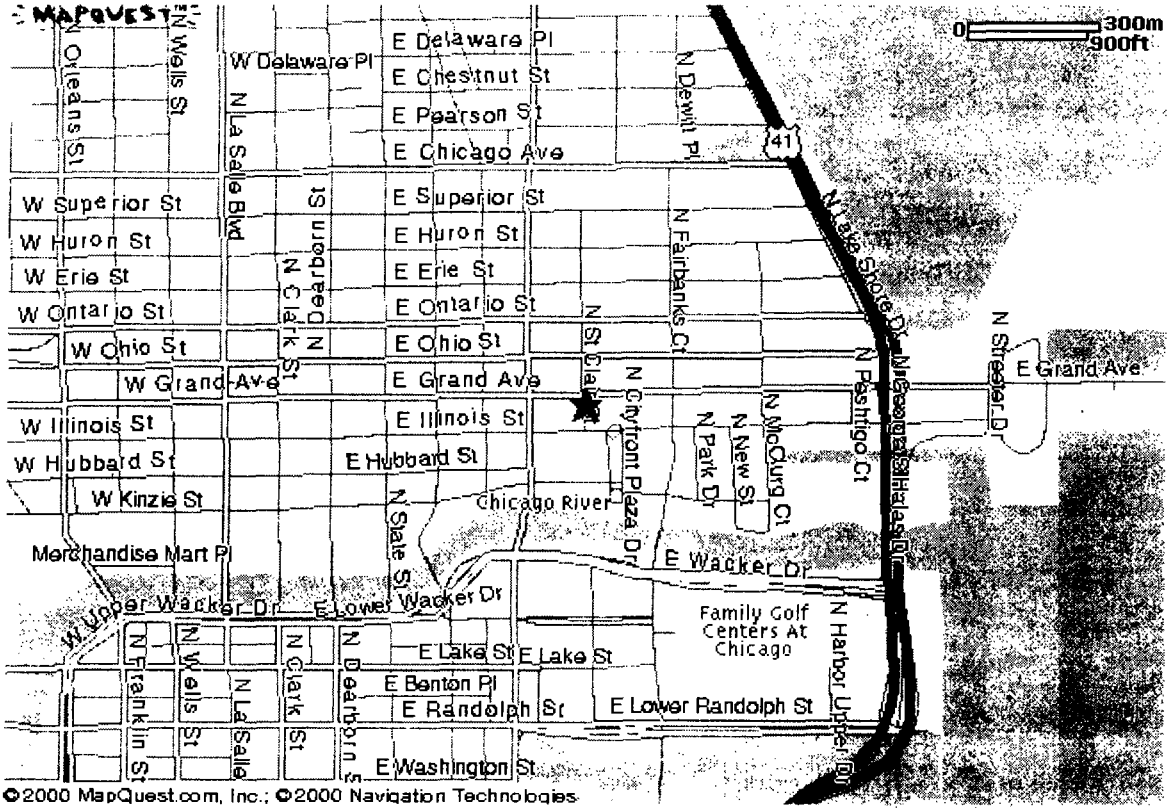
The USEPA indoor radon program ascribes a national average indoor radon-222 concentration as 1.3 picocuries per liter (pCi/L). USEPA does not specify a comparable radon-220 concentration for the US. Thoron measurements are difficult to come by in the technical literature but in Sources and Effects of Ionizing Radiation, Volume I, issued by the United Nations Scientific Committee on the Effects of Atomic Radiation in 2000, an average indoor level of 0.3 pCi/L (10 Becquerels per cubic meter, Bq/m^3) is given. The same concentration was found as an average indoor US thoron concentration in the book Gaseous Pollutants: Characterization and Cycling, S.D. Schery and D.M. Grumm.

See Attachment 6

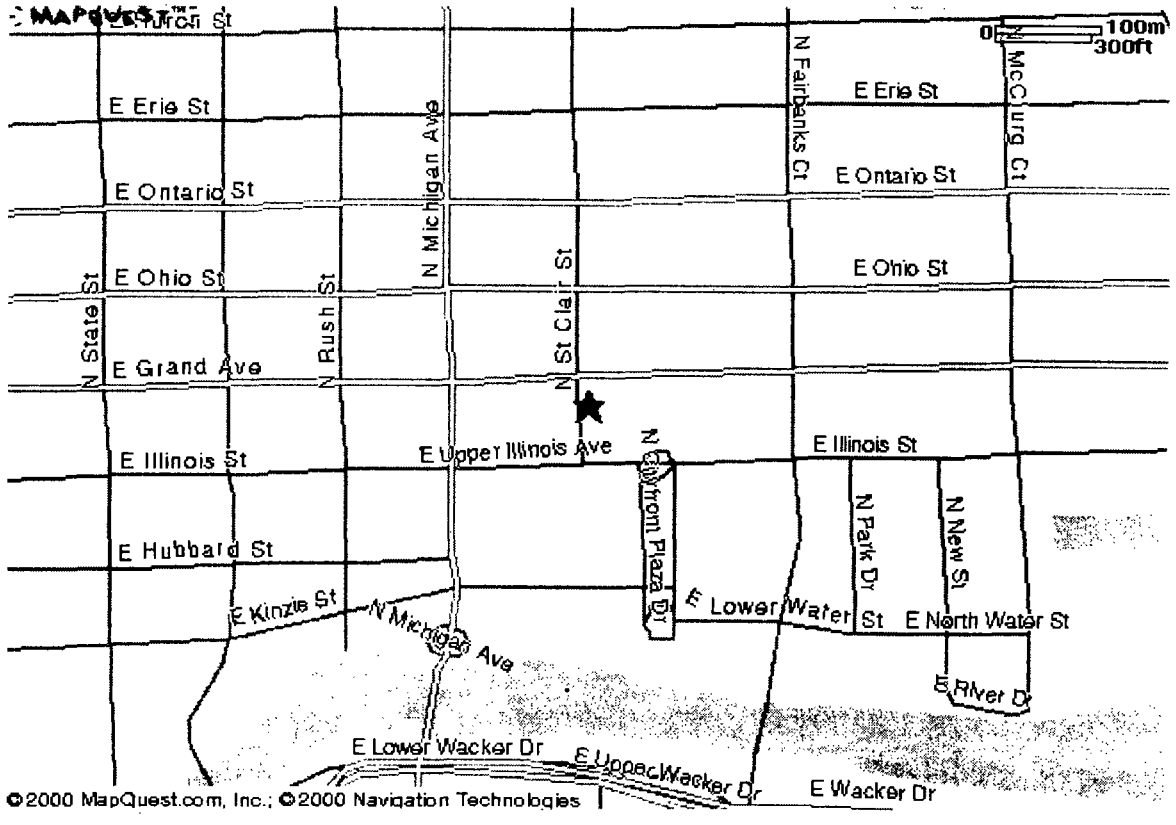
ATTACHMENT 1

City of Chicago maps showing site location

★ 201 E. Grand Avenue, Chicago, IL 60611-3311 Sav



★ 201 E. Grand Avenue, Chicago, IL 60611-3311



ATTACHMENT 2

Floor Drawings showing measurements of gamma count rate

Main Floor

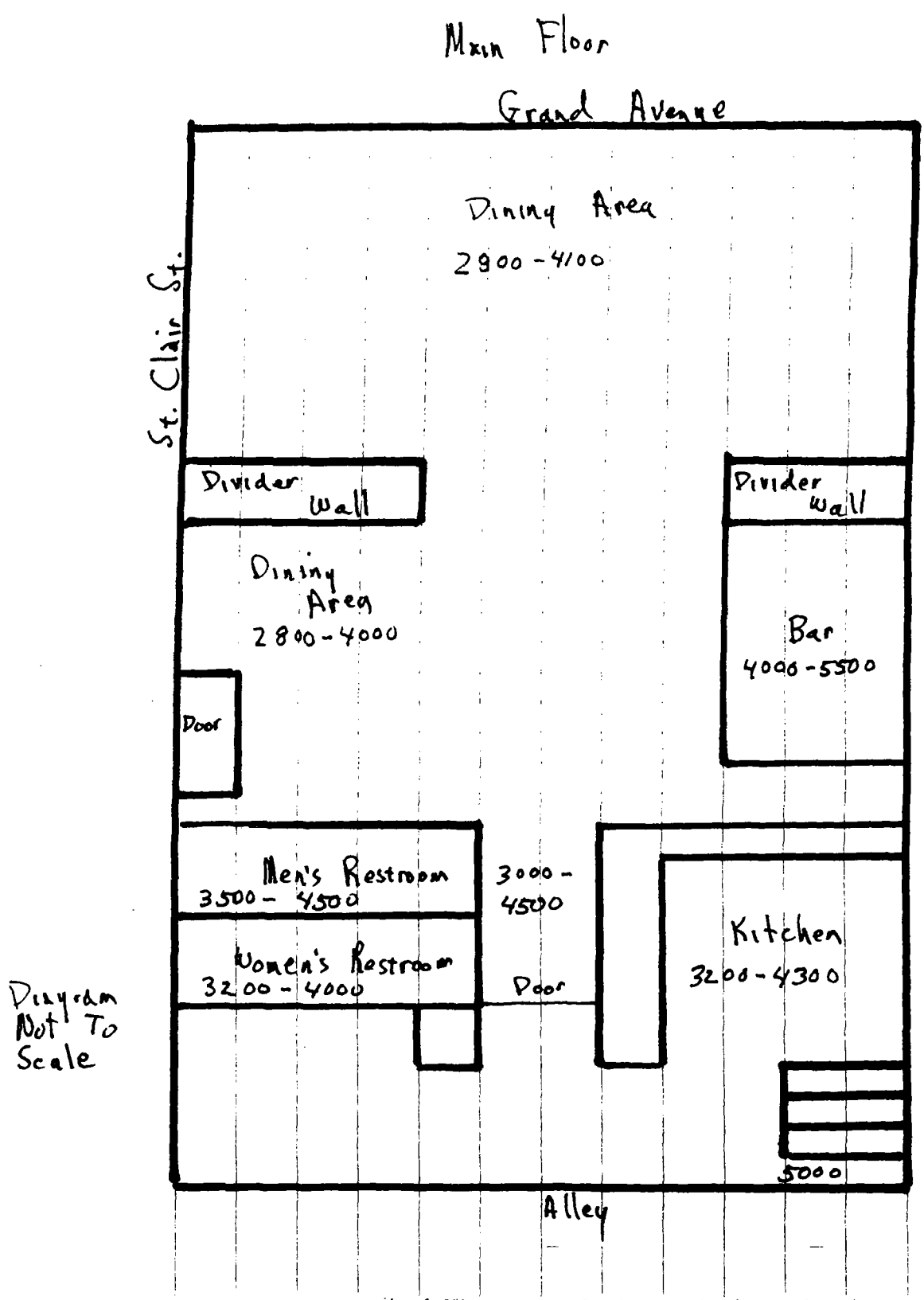
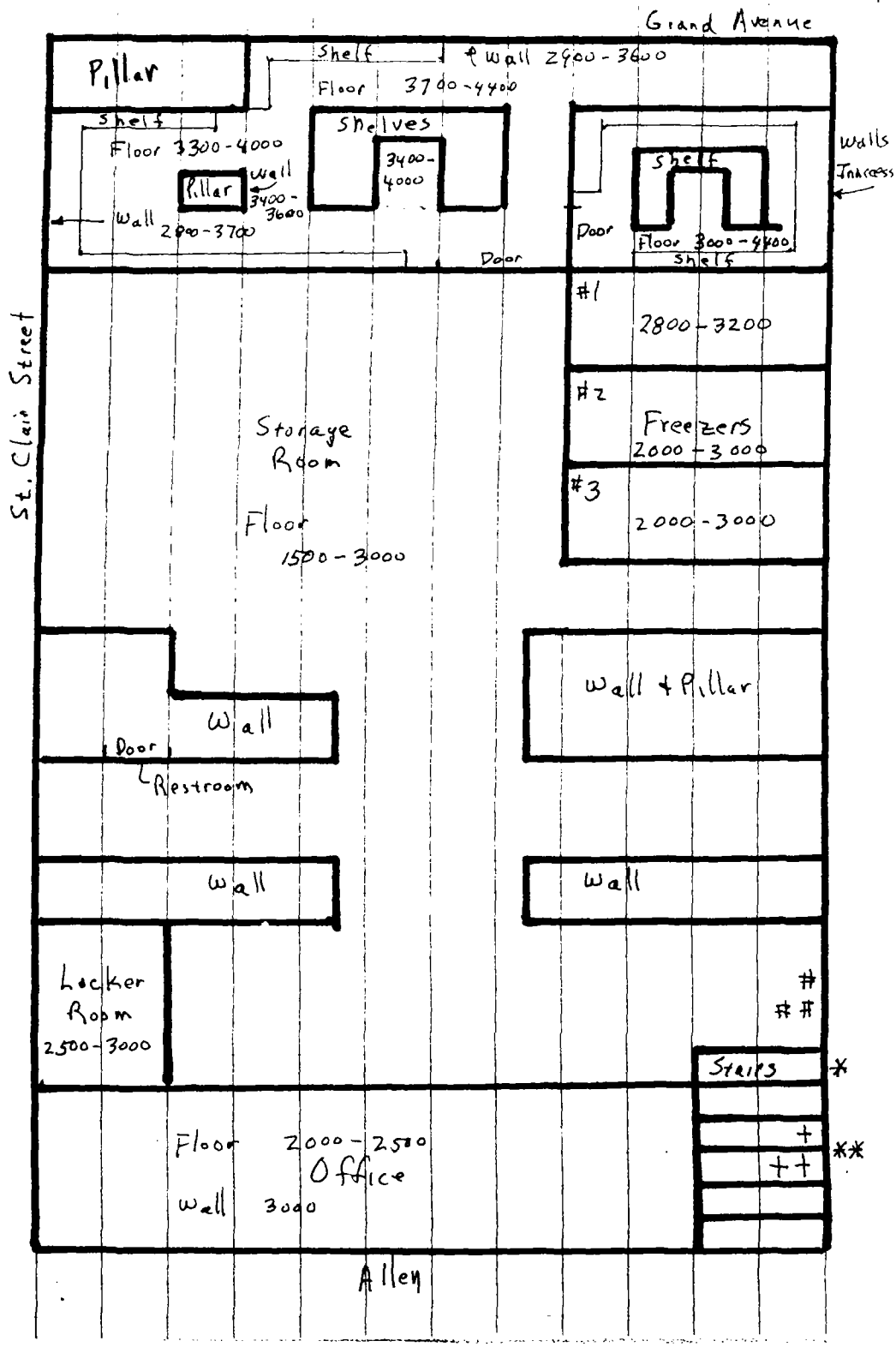


Diagram Not To Scale

Basement



#	Top 2/3 of wall	7500 - 8800 cpm	17 uR/hr
##	Bottom 1/3 of wall	3000 - 4000 cpm	
*	Wall at bottom of stairs	3000 cpm	
**	Wall along stairs	5500 - 7000 cpm	12 - 14 uR/hr
+	Floor under steps	2500 - 3500 cpm	
++	Wall under steps	2500 - 3800 cpm	

Diagram Not to Scale

ATTACHMENT 3

Floor Drawings showing measurements of gamma exposure rate

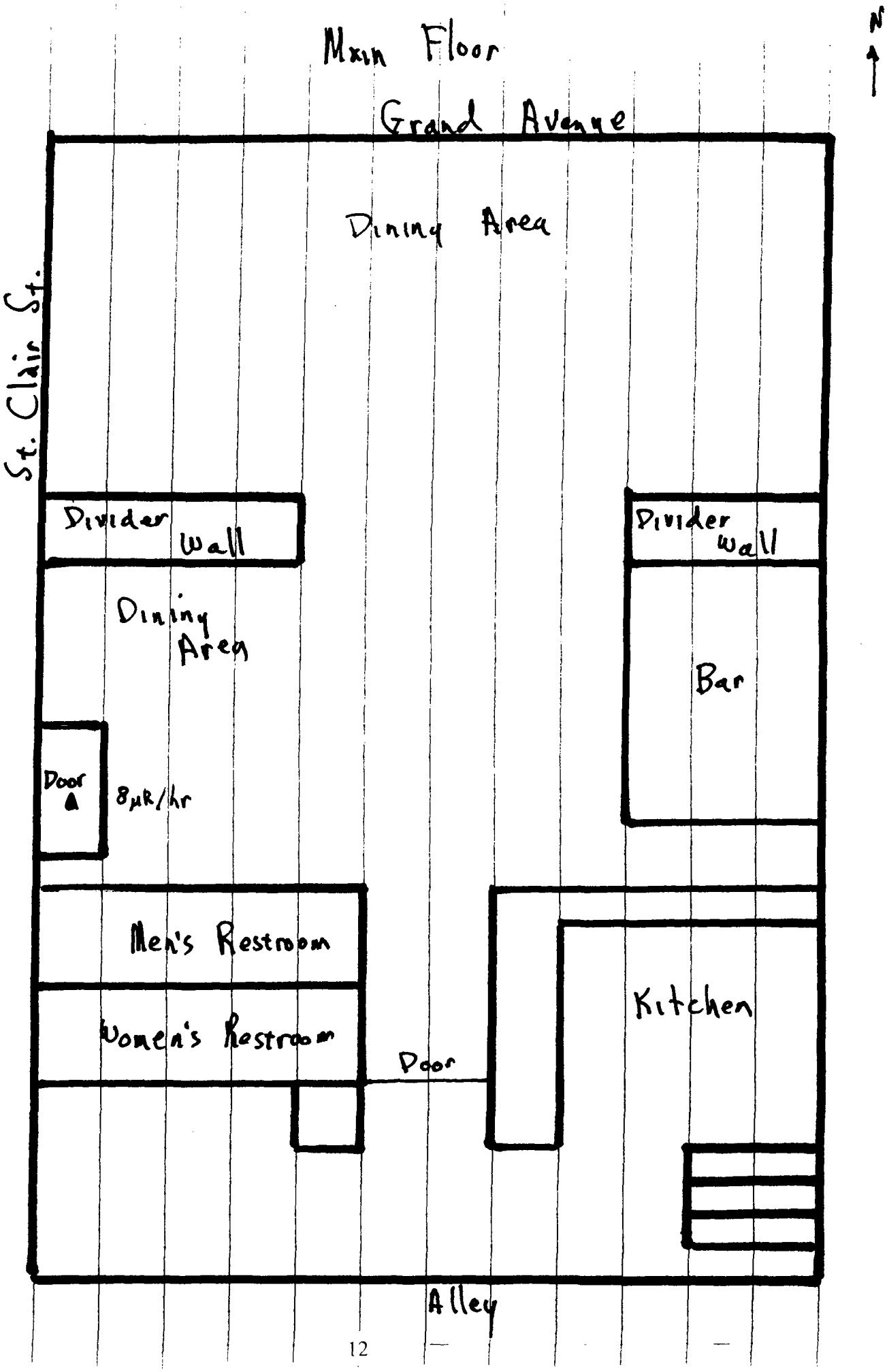


Diagram Not To Scale

Basement

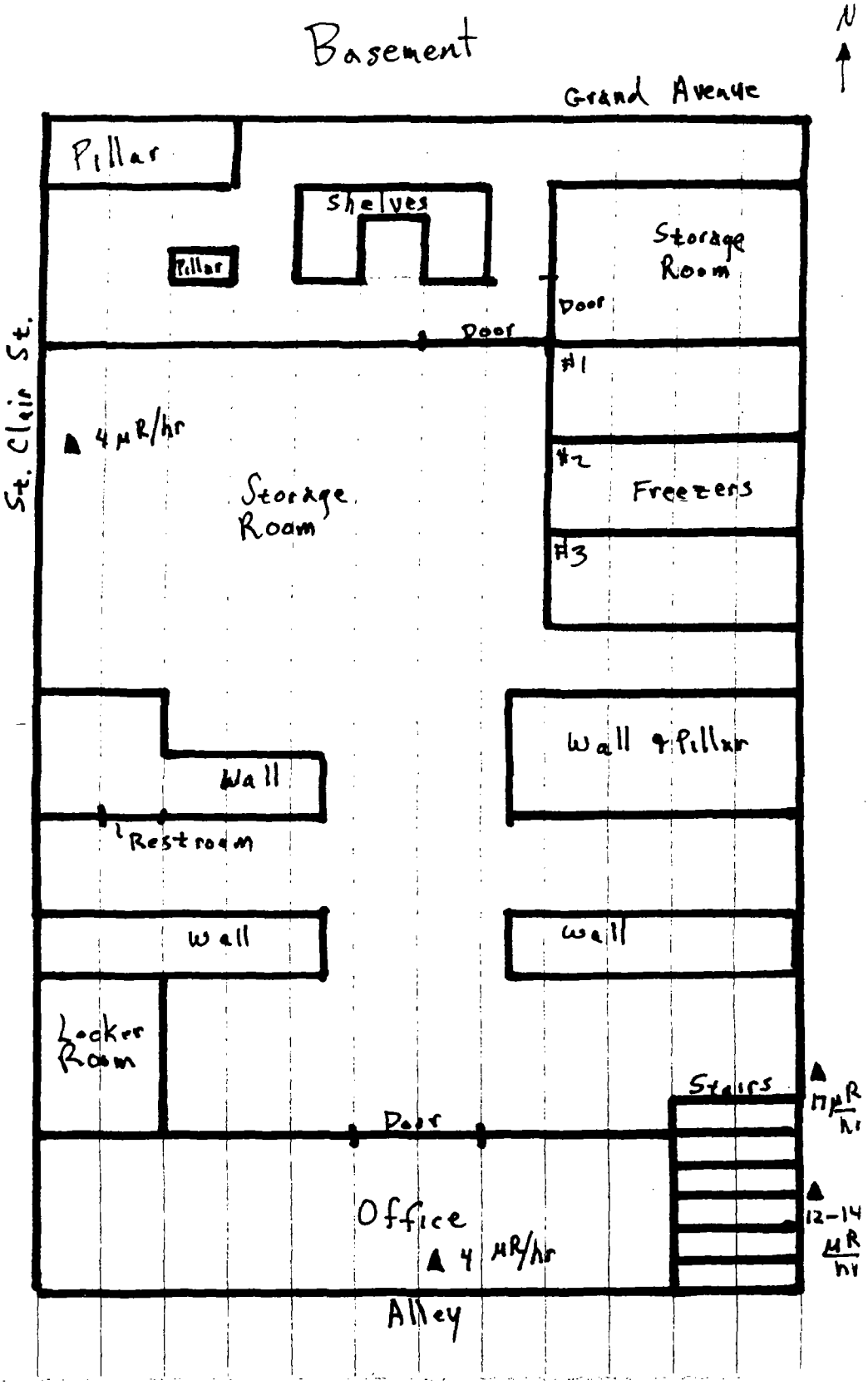


Diagram Not To Scale

ATTACHMENT 4

Floor plans showing sites of radon-220 and radon-222 measurements

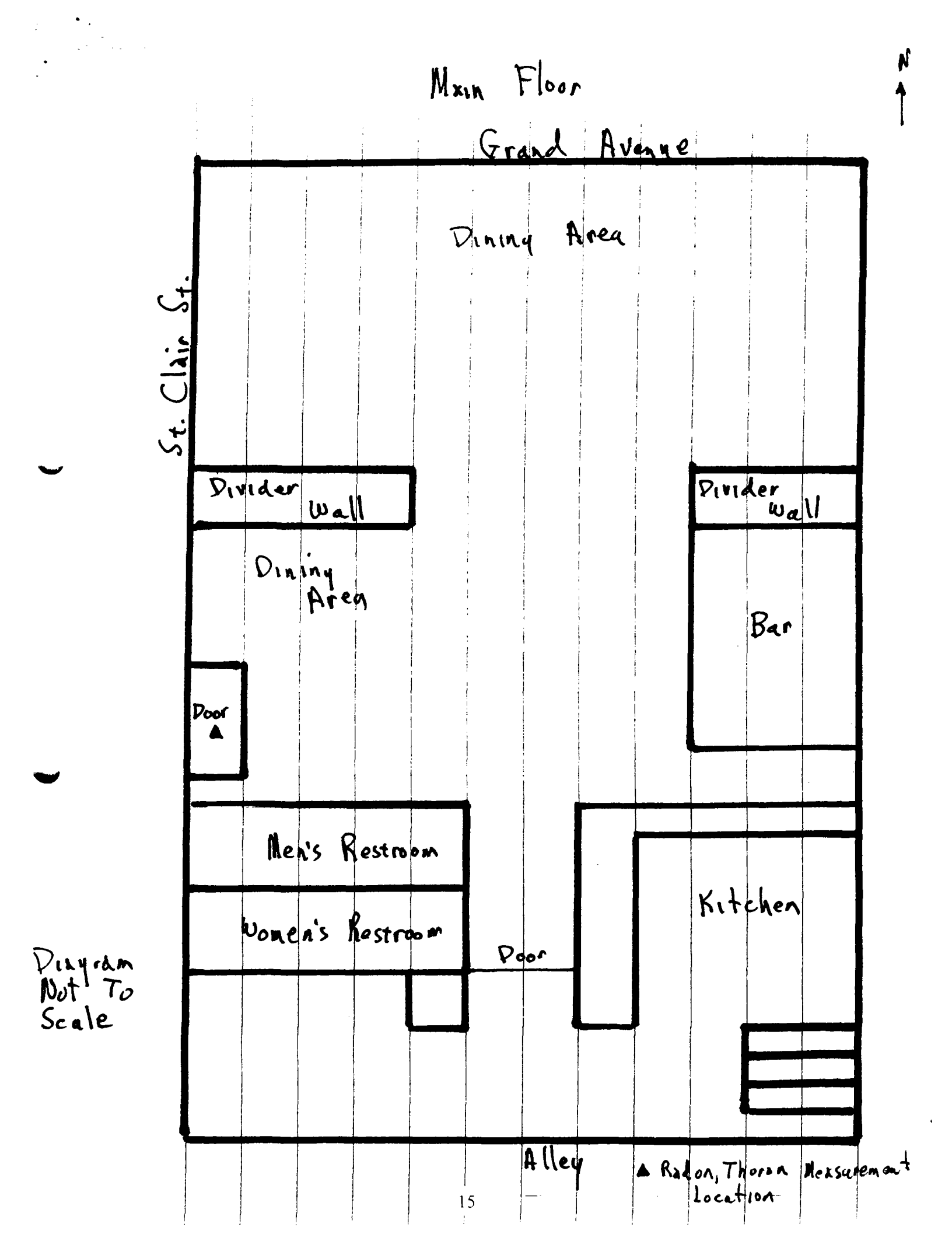


Diagram Not To Scale

Basement

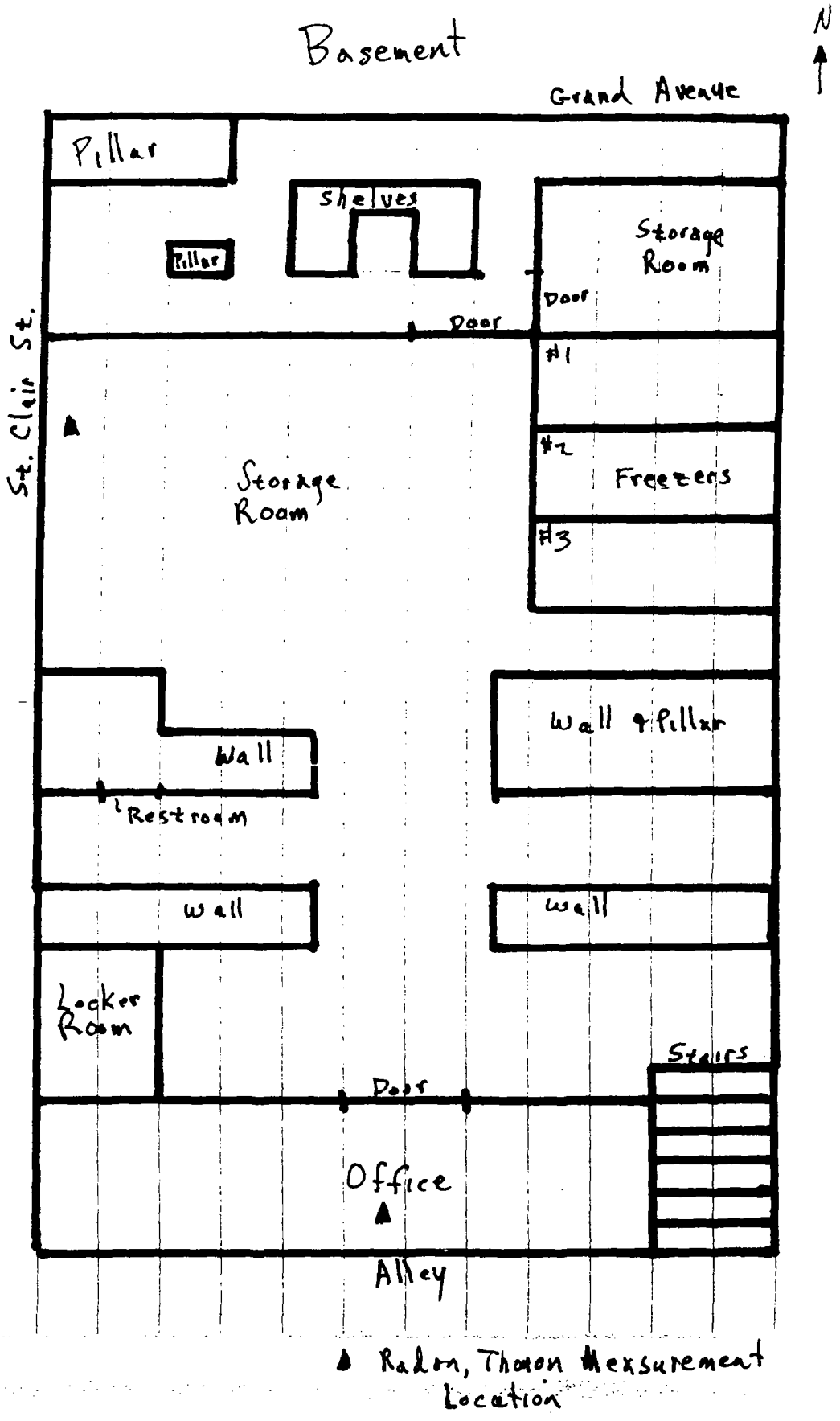


Diagram Not To Scale

ATTACHMENT 5

Measured radon-220 and radon-222 concentrations

Volare Ristorante Italiano, 201 East Grand Avenue, Chicago, Illinois

Spread sheet template for calculating time differences

Description	Tn Electret#	Rn Electret#	StartTest	Finish Test	Days.
1st Floor					
Over Front Door	SW5917		7/3/01 7:36:00 PM	7/16/01 7:54:00 PM	13.01
		SW5922	7/3/01 7:36:00 PM	7/16/01 7:55:00 PM	13.01
Basement					
Storage Shelf	SW5864		7/3/01 7:40:00 PM	7/16/01 8:04:00 PM	13.02
		SW5852	7/3/01 7:41:00 PM	7/16/01 8:05:00 PM	13.02
Basement					
Office	SW5886		7/3/01 9:16:00 PM	7/16/01 8:03:00 PM	12.95
		SW6009	7/3/01 9:19:00 PM	7/16/01 8:02:00 PM	12.95

Volare Ristorante Italiano, 201 East Grand Avenue, Chicago, Illinois

Spread sheet for calculating thoron and radon concentrations

Area	Thoron Initial	Thoron Final	Radon Initial	Radon Final	Thoron Calib. Factor	Radon Calib. Factor	Time	Average Gamma Exposure Rate, Background	Thoron Conc.	Radon Conc.	Corrected Radon Concentration
	volts	volts	volts	volts			days	micro R/h	pCi/L	pCi/L	pCi/L
1st Floor											
Over											
Front											
Door											
SW5917	664	632			0.7228		13.01	8	1.3		
SW5922			654	634		2.068	13.01	8		0.05	0.0
Basement											
Storage											
Shelf											
SW5864	658	615			0.7205		13.02	4	0.4		
SW5852			594	555		2.0276	13.02	4		1.1	1.1
Basement											
Office											
SW5886	683.5	651			0.72665		12.95	6	-1.4		
SW6009			659	613.5		2.0631	12.95	6		1.2	1.2

ATTACHMENT 6

Radon versus Thoron Risk Comparison

COMPARISON OF THORON TO RADON RISK

For a radon (radon-222) concentration of 1 picocurie per liter (pCi/L) the mortality risk is

(1)(0.4/100)(A/B)(C)(D)

where 1 = radon-222 concentration, pCi/L
0.4 = radon-222 equilibrium fraction, unitless
Federal Register, Volume 64, No. 211, November 2, 1999, page 59313
100 = radon-222 equilibrium concentration, pCi/L per working level, WL
Limits for Inhalation of Radon Daughters by Workers
International Commision on Radiological Protection,
ICRP Publication 32, page 19
A = hours per year
B = conversion parameter, (WL-hours)/(working level month, WLM)
C = occupancy factor, fraction of full year for which individual at Volare is exposed
D = inhalation risk coefficient, lung cancer deaths per WLM

For a thoron (radon-220) concentration of 1 picocurie per liter (pCi/L) the mortality risk is

(1)(0.02/7.43)(A/B)(C)(D)(0.2)

where 1 = radon-220 concentration, pCi/L
0.02 = radon-220 equilibrium fraction, unitless
Comparative Dosimetry of Radon in Mines and Homes, National Research Council, 1991, page 49
7.43 = radon-220 equilibrium concentration, pCi/L per working level, WL
Limits for Inhalation of Radon Daughters by Workers
International Commision on Radiological Protection
ICRP Publication 32, page 19
A = hours per year
B = conversion parameter, (WL-hours)/(working level month, WLM)
C = occupancy factor, fraction of full year for which individual at Volare is exposed
D = inhalation risk coefficient, lung cancer deaths per WLM
0.2 = thoron risk per WLM versus radon risk per WLM
Comparative Dosimetry of Radon in Mines and Homes, National Research Council, 1991, page 50

Ratio of thoron mortality risk to radon mortality risk

[(1)(0.4/100)(A/B)(C)(D)] / [(1)(0.02/7.43)(A/B)(C)(D)(0.2)] = 13%

ATTACHMENT 7

Instrumentation information

Instrumentation used at the survey of the Volare Ristorante Italiano, Chicago, Illinois

FIDLER

Ludlum	Model	2221	S/N 102047	Pair	
Bicron	Model	G5	S/N B089D	Calibrated	8/29/2000

Micro-R Meter

Ludlum	Model	19	S/N 101728	Calibrated	3/15/2001

E-Perm Reference Electrets

Rad Elec		S/N R1765	
Rad Elec		S/N R1766	

E-Perm Reader

Rad Elec			S/N RE2016B	Calibrated 1	10/4/2000